REMARKS

There are no amendments herein. Claims 1-11, 13-15, 17-18, 28-30, and 32-37 are currently pending in the case. Further examination and reconsideration of the presently claimed application is respectfully requested.

Section 112 Rejection

Claims 1-11, 13-15, 17-18, 28-37 were rejected under 35 U.S.C. § 112, first paragraph, for failing to comply with the written description requirement. It is noted that claim 31 was canceled in a previous response rendering rejection thereto moot. In particular, the Examiner suggests that "Applicant has not shown where in the specification teaching of the limitation of using the noble gases wherein the first noble gas is different from the second noble gas and the limitation of 1st, 2nd, and 3rd noble gases differ from the remaining noble gases." (Final Office Action, page 7). The Applicants disagree with the alleged lack of support, and hereby traverse this rejection.

As note on page 11 of the Response to the Office Action Mailed May 2, 2005, Applicants specifically pointed out that support of such teaching could be found on page 13, line 7 to page 14, line 10 of the present specification. In addition to the passages noted in the previous Response, further support for the above-mentioned limitations may be found, e.g., on page 4, lines 1-17 and page 21, lines 5-21 of the present specification. Additional support may exist. Accordingly, Applicants respectfully request that this rejection be removed.

Section 102 Rejections

Claims 1 and 4-8 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,630,407 to Keil et al. (hereinafter "Keil"). The standard for "anticipation" is one of fairly strict identity. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. Of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987), MPEP 2131. Keil does not disclose all limitations of the currently pending claims, some distinctive limitations of which are set forth in more detail below.

Kiel fails to anticipate a method for etching a stack of layers (comprising an anti-reflective layer, a nitride layer and an underlying layer), where the method includes etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack. Independent claim 1 recites in part:

> A method for processing a semiconductor topography, comprising: etching a stack of layers within a single etch chamber, wherein the stack of layers comprises: an anti-reflective layer; a nitride layer arranged beneath and in contact with the antireflective layer; an underlying layer arranged beneath the nitride layer; and wherein said etching a stack of layers comprises etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack ...

Independent claims 11 and 29 recite similar limitations.

Statements in the Final Office Action admit that "Keil doesn't describe etching [one or more] layers in the stack with a different etch chemistry than used for etching other layers in the stack" or "etching the underlying layer with an etch chemistry different [than] that of the first and second etch chemistries" (see, Final Office Action, page 3). However, the Examiner suggests that "[s]ince claim 1 requires etching one or more layers, the limitation of ... etching more layers in the stack with a different etch chemistry than used for etching other layers in the stack ... doesn't have the patentability because it applies to the etching of at least 2 layers, which is not necessarily to be done or required." (Final Office Action, page 2, emphasis original). As described in more detail below, the Applicants strongly traverse any implication that the above-mentioned limitation may lack patentability.

In light of the Office Action statement, it appears that the Examiner has either misunderstood or misread the limitation actually recited in claim 1. For example, and contrary to the above statement, claim 1 does NOT require the etching of one or more layers. Instead, claim 1 recites a limitation on "etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack." Therefore, claim 1 suggests that although multiple stack layers may be etched (e.g., at least two stack layers, as pointed out by the Examiner), one or more layers in the stack are etched with a different etch chemistry than used for etching other layers in the stack. The claim limitation is not contradictory or confusing when read in full. The fact that the Examiner was confused by the limitation is not sufficient to render the claim unpatentable.

Since Keil fails to disclose the above-mentioned limitation (a fact admitted by the Examiner), Keil cannot be relied upon to anticipate all limitations of independent claim 1. Therefore, claim 1 and all claims dependent therefrom are asserted to be patentably distinct over the cited art. Accordingly, Applicants assert that the § 102(e) rejections of claims 1 and 4-8 cannot be maintained.

Section 103 Rejections

Claims 2, 3, 11, 13-15, 17, 18, 28-33, 35 and 37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Keil in view of U.S. Patent No. 6,117,786 to Khajehnouri et al. (hereinafter "Khajehnouri"). In addition, claims 9 and 10 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keil. Furthermore, claims 34 and 36 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keil in view of U.S. Patent No. 6,403,484 to Lim et al. (hereinafter as "Lim"). To establish a case of *prima facie* obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (C.C.P.A 1974); MPEP 2143.03. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed.Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); MPEP 2143.01. The cited art does not teach or suggest each and every limitation of the currently pending claims, some distinctive limitations of which are set forth in more detail below.

Keil and Khajehnouri each fail to provide teaching, suggestion or motivation for etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack, and therefore, cannot be combined or modified to do so. As noted above, independent claims 1, 11 and 29 each recite limitations on etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack. For example, claim 11 recites in part:

> A method for processing a semiconductor topography, comprising ... etching an anti-reflective layer ... with a first etch chemistry ... etching a cap layer ... with a second etch chemistry ... etching a lower layer ... with a third etch chemistry ... wherein at least one of the first, second and third etch chemistries differs from the other etch chemistries ...

In addition, claim 29 recites in part:

> A method for processing a semiconductor topography, comprising etching a stack of layers in a single etch chamber with a sequence of different etch chemistries ... wherein the step of etching the stack of layers comprises: etching an antireflective layer with a first etch chemistry ... [and] etching a silicon nitride layer ... with a second etch chemistry different than the first etch chemistry ...

As noted above, Keil simply fails to provide teaching or suggestion for etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack. In fact, the Examiner agrees that teaching or suggestion for the claim limitation cannot be found within Kiel (*see*, Office Action, page 3). However, the Examiner appears to suggest that such a feature may be implicitly or inherently described within the teachings of Keil. The Applicants disagree as described in more detail below.

For example, the Examiner states that although Keil fails to provide explicit teaching for the claim limitation, Keil "describes etching the ARC layer in the stack selectively to above and under layers (col. 3, line 25-32) and he teaches that the selective etching is to minimize attacking of the under layers and to improve the uniformity, CD, and profile of the openings (col. 4, line 1-18)." (Final Office Action, page 6). Therefore, the Examiner concludes that "one skilled in the art would find it obvious to etch other layers selectively, which would have to require different etch chemistry for each layer [in the stack], in order to provide improvement in uniformity, profile, and CD of the openings." (Final Office Action, page 6). For at least the reasons set forth below, the Applicants strongly disagree that, in order to etch the upper and lower layers selectively, the etch process of Keil would require a different etch chemistry for each layer in the stack.

The *only* etch chemistry disclosed by Keil is the ARC etch chemistry used during the ARC etch process. This etch chemistry, which may include a "carbon-containing gas such as CO gas, a nitrogen containing gas such as N_2, an optional oxygen containing gas such as O_2, and an optional inert carrier gas such as Ar" (*see*, Keil, Abstract), is used for overcoming "a problem associated with etching an ARC layer with fluorine." (Keil, column 3, lines 55-56). For example, Keil discloses that the "use of fluorocarbon gases to generate a protective polymer on... the etched openings of the ARC can cause profile and uniformity issues due to attack of the underlying layer by the fluorine atoms present in the plasma." (Keil, column 3, lines 56-61). To minimize the attack on underlying dielectric layers during the ARC etch, Kiel uses a fluorine-free, carbon-containing etchant gas (preferably, carbon monoxide, CO), which is chosen for its high selectivity to materials used in dielectric layers (e.g., oxides). The high selectivity of the fluorine-free, carbon-containing etchant gas minimizes CD loss and improves the uniformity and profile of the etch by etching the underlying dielectric layer at a much slower rate than if fluorine-based etchant gases were used in the ARC etch. (*See*, e.g., Keil, column 4, lines 1-25).

Keil fails to disclose any other etch chemistry, which may be used for etching other stack layers, and which may differ from the etch chemistry mentioned above for etching the ARC layer. Therefore, the Applicants agree with the Examiner that Keil fails to provide explicit teaching for etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack, as recited in present claims 1, 11, and 29.

However, the Applicants disagree with the Examiner's contention that Keil somehow provides suggestion or motivation that would enable one skilled in the art to modify the teachings of Keil to include such a limitation.

In the final Office Action, the Examiner assumes that since Keil discloses an ARC etch chemistry having a high selectivity to overlying and underlying layers, the etch process of Keil necessarily requires a different etch chemistry for each layer in the stack. This is an incorrect assumption. As is known in the art, an etch chemistry – which is more selective to layer A than layer B -- will simply etch layer A at a different rate than it will etch layer B. However, both layers A and B can still be etched with the same etch chemistry. In other words, merely pointing out that the etch chemistry disclosed by Keil is less selective to the ARC layer and more selective to underlying and overlying layers does not prove that the etch process of Keil necessarily requires a different etch chemistry for each layer in the stack.

Arguments were provided in a previous Response to the Office Action mailed May 2, 2005 to indicate that Keil uses the same etch chemistry for etching the ARC layer and underlying lying dielectric layer (see, e.g., Response to Office Action, pages 8-9). For example, Applicant's noted:

> Keil states that a carbon-containing ARC etch chemistry (e.g., CO) with a high selectivity to the underlying layer is chosen, so that "when the dielectric layer is reached, the dielectric layer is etched at a slower rate than in the case where fluorine containing etchant gases are used" for etching the ARC layer. (*See*, Keil, column 4, lines 15-25).

In the final Office Action, the Examiner suggests that the Applicant's arguments were "unpersuasive because he only describes the affective of the CO on the underlying dielectric layer, but not a step of etching the underlying dielectric layer." (Final Office Action, page 6). The Applicants disagree. In the above-mentioned passage, Keil specifically states that "when the dielectric layer is reached, the dielectric layer is etched at a slower rate than in the case where fluorine containing etchant gases are used" for etching the ARC layer. As such, Keil specifically describes an etch process in which an ARC layer and a dielectric layer are both etched using the same etch chemistry.

Since Keil fails to provide teaching, suggestion or motivation for changing the etch chemistry used for etching the underlying dielectric layer after etching the ARC layer, and the Examiner fails to provide conclusive proof that a different etch chemistry is necessarily required for etching each layer in the stack., Applicants assert that Keil cannot be modified to do so. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed.Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); MPEP 2143.01. As set forth in MPEP 2143, the teaching or suggestion for making the proposed modification must be found in the prior art, not in the applicant's disclosure.

Although Khajehnouri is not cited for teaching the above-mentioned limitation, Applicant's assert that Khajehnouri cannot be combined with Keil to overcome the deficiencies therein. In particular, Khajehnouri fails to provide teaching, suggestion or motivation for etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack. Therefore, even if Khajehnouri were combined with Keil (without sufficient motivation to do so), the combined teachings of the cited art would still fail to disclose all limitations of present claims 1, 11, and 29.

Keil and Khajehnouri each fail to provide teaching, suggestion or motivation for etching the stack of layers within a single, low density plasma etch chamber configured for etching a material comprising silicon, and therefore, cannot be combined or modified to do so. Independent claim 11 recites in part:

> A method for processing a semiconductor topography, comprising: etching an anti-reflective layer in a low density plasma etch chamber with a first etch chemistry, wherein the low density plasma etch chamber is configured for etching a material comprising silicon; etching a cap layer in the etch chamber with a second etch chemistry ... etching a lower layer in the etch chamber with a third etch chemistry ...

Independent claim 11 includes a further limitation, which states that the stack of layers are etched within a low density plasma etch chamber, and more specifically, an etch chamber configured for etching a material comprising silicon.

In the present specification, a low density plasma etch chamber is described as an etch tool with a plasma density between approximately 2.0×10^9 molecules/cm^3 and approximately 2.0×10^{11} molecules/cm^3. One example of a low density plasma etch chamber is a "silicon etch chamber," or an etch chamber specifically configured for etching a material comprising silicon. On the other hand, "oxide

etch tools" are generally used for etching materials comprising oxides, and therefore, are generally configured for producing medium to high density plasmas (e.g., densities of approximately 2.0 x 10^{14} molecules/cm^3 and approximately 2.0 x 10^{17} molecules/cm^3 for high density plasmas). The present specification notes that "oxide etch tools" are substantially different from "silicon etch tools". For example, in addition to producing medium-to-high density plasmas (as opposed to low density plasmas), oxide etch tools tend to produce a significantly lower number of defects than silicon etch tools (*see*, e.g., Specification, page 2, lines 1-19). The current claim limitation specifically limits the etch process to being conducted within a low density plasma etch chamber. This is not taught or suggested by Keil or Khajehnouri.

Keil and Khajehnouri each fail to provide teaching or suggestion for etching the stack of layers within a low density plasma etch chamber configured for etching a material comprising silicon. Instead, Keil teaches that the stack of layers are etched within an "oxide etch system", or in other words, an etch chamber specifically configured for etching a material comprising oxygen. (*See*, e.g., Keil, column 4, lines 26-38). As noted above, oxide etch systems are typically configured for generating high density plasmas -- not low density plasmas, as presently claimed. In addition, Keil suggests that the oxide etch system may be a capacitively coupled plasma reactor or an inductively plasma reactor, which are used for generating medium to high density plasmas, respectively (*see*, e.g., Keil, column 7, lines 7-60). Keil never once suggests that a low density plasma etch chamber configured for etching a material comprising silicon (i.e., a "silicon etch system") could be alternatively used for etching the stack of layers. As such, Keil cannot be relied upon to provide such teaching.

Statements in the final Office Action suggest that the etching reactor of Keil includes an inductively coupled plasma reactor (col. 2, line 23), which is also a low-density plasma etch chamber (please see cited art below)." Even though Keil specifically teaches that the inductively coupled plasma reactor is a high-density plasma etch chamber (*see*, e.g., Keil, column 7, lines 10-15), the Examiner appears to suggest that the remaining cited art somehow equates an inductively coupled plasma reactor to a low-density plasma etch chamber. This is not the case. For example, Khajehnouri specifically states that an inductively coupled plasma reactor is a high-density plasma etch chamber (*see*, e.g., Khajehnouri, column 1, lines 25-30). Hung also indicates that an inductively coupled plasma reactor is a high-density plasma etch chamber (*see*, e.g., Hung, column 6, lines 48-50). The remaining cited art (Lim) fails to mention the use of high or low density plasma etch chambers. Therefore, none of the cited art teaches or suggests that an inductively coupled plasma reactor could also be used as a low-density plasma etch chamber.

Although Khajehnouri is not cited for teaching the above-mentioned limitation, Applicant's assert that Khajehnouri cannot be combined with Keil to overcome the deficiencies therein. In particular, Khajehnouri fails to provide teaching, suggestion or motivation for etching the stack of layers within a low density plasma etch chamber configured for etching a material comprising silicon. Instead, Khajehnouri teaches that etching of a silicon oxide layer may be carried out in a medium density or high density plasma reactor (see, e.g., Khajehnouri, column 1, lines 21-30, column 2, lines 1-5, etc.) Khajehnouri never once suggests that a low density plasma etch chamber could be used for etching the silicon oxide layer. Therefore, even if Khajehnouri were combined with Keil (without sufficient motivation to do so), the combined teachings of the cited art would still fail to disclose all limitations of present claim 11.

For at least the reasons set forth above, the cited art fails to teach or suggest, and cannot be combined or modified to teach or suggest, many of the limitations recited in independent claims 1, 11, and 29. Therefore, claims 1, 11, and 29, as well as claims dependent therefrom, are patentably distinct over the cited art. Accordingly, removal of this rejection is respectfully requested.

CONCLUSION

This response constitutes a complete response to all issues raised in the final Office Action mailed October 19, 2005. In view of the remarks traversing the rejections, Applicants assert that pending claims 1-11, 13-15, 17-18, 28-30, and 32-37 are in condition for allowance. If the Examiner has any questions, comments, or suggestions, the undersigned earnestly requests a telephone conference.

No fees are required for filing this amendment; however, the Commissioner is authorized to charge any additional fees, which may be required, or credit any overpayment, to Daffer McDaniel LLP, Deposit Account No. 50-3268/5298-06900.

Respectfully submitted,

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